How to Purchase Green Lighting Equipment

Association of Bay Area Governments

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How to Specify Low-mercury and Lead-free Lighting Equipment

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Local Government Energy Partnership

Brought to you by the Association of Bay Area Governments

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

COUNTY OF ALAMEDA CALIFORNIA

BAY AREA GREEN BUSINESS PROGRAM

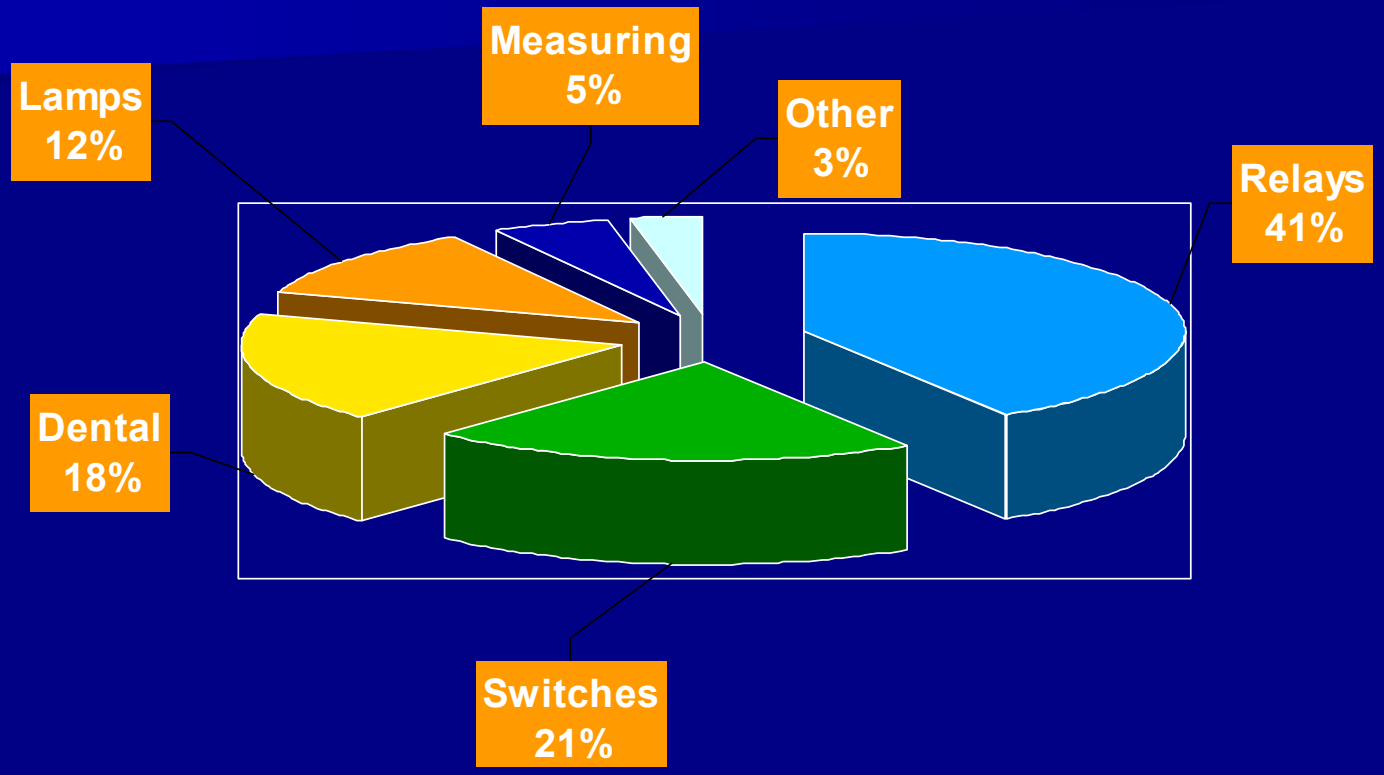
Enviro√Spec

- **Helps government agencies, businesses and institutions reduce their purchase of products containing toxic chemicals.**
- **Mission to change manufacturing practices**

Presentation Overview

- Describes how mercury can contaminate the environment during the manufacture, installation and disposal of fluorescent, HID and neon lamps
- Explains why exposure to mercury and lead presents human health risks
- Identifies lamps that contain mercury and lead as well as low-mercury and lead-free replacements
- Details specifications and other strategies for reducing mercury and lead in lighting equipment as well as emissions from power plants

Mercury In Products



Maine Department of Environmental Protection, *A Strategy to Reduce the Mercury Content of Products: Report to the Joint Standing Committee on Natural Resources,* January 2003, http://mainegov-images.informe.org/dep/mercury/productsweb.pdf

Mercury and Lead is Released from Lamp Manufacturing

A fluorescent lamp plant in Bucyrus, Ohio released nearly 60,000 pounds of lead compounds to landfills, and over 100 pounds of mercury into air, a sewage treatment plant (POTW), and landfills in 2003.

Another 158,000 pounds of lead compounds were recycled.

Source: US EPA Toxics Release Inventory, 2003; see www.scorecard.org

Mercury Is Released When Lamps Break

During transportation, installation, or removal.

- **Most mercury is released as a vapor**
- **Special requirements are needed for cleanup**

How Much Mercury is Released When Lamps Break?

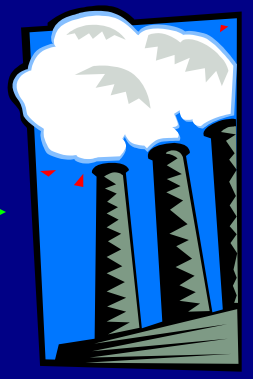
- **17 to 40% in first 2 weeks**
- **Higher temperature → more emissions**
- **Airborne mercury near recently broken bulb can exceed workplace safety limits**

Source: New Jersey Department of Environmental Protection, *Release of Mercury From Broken Fluorescent Bulbs*, 2004, http://www.state.nj.us/dep/dsr/research/mercury-bulbs.pdf

Mercury and Lead is Released When Lamps are Discarded

Mercury and lead can be released when lamps go into trash incinerators or landfills.

- **Lamps release mercury if broken at the curb, in a dumpster or during transport.**
- **Mercury is found in landfill gas and groundwater.**



How Many Lamps Enter the Waste Stream?

- **514 million "mercury-added" lamps enter the solid waste stream annually**
  - **372 million from business, government and institutions (72.4%)**
  - **142 million from residences (27.6%)**

Source: National Electrical Manufacturer's Association,
www.nema.org/lamprecycle/docs/ALMR_capacity_statement.pdf

US Mercury Lamp Recycling Rate Low

70.8% of the mercury-added lamps used by business and 98% of the lamps used in homes are not being recycled.

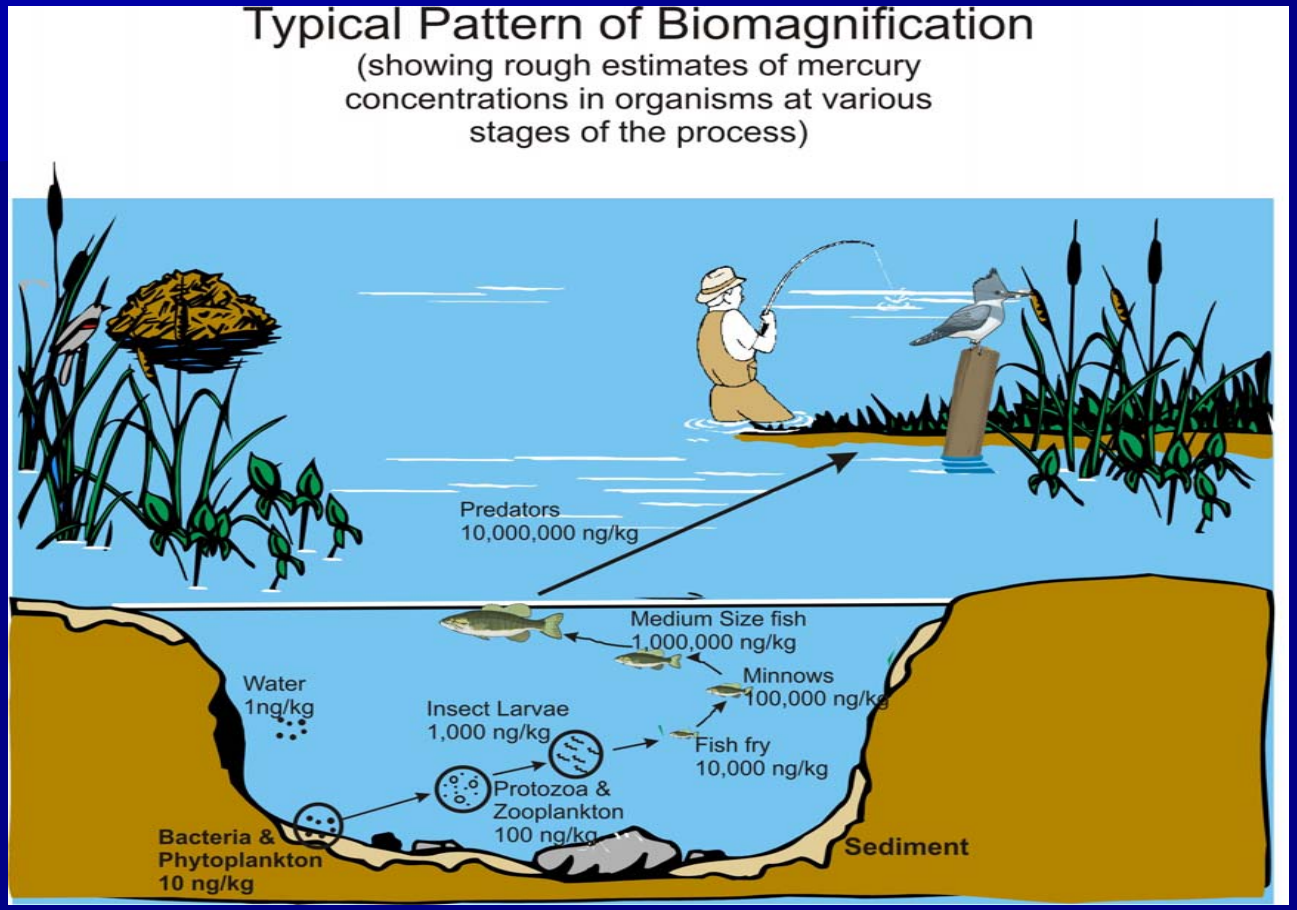
Source: Association of Mercury Lamp Recyclers, "National Mercury-Lamp Recycling Rate," November 2004,

www.nema.org/lamprecycle/docs/ALMR_capacity_statement.pdf

Lamp Recycling a Panacea?

- **Most mercury is recovered during recycling**
- **Some mercury may be released during recycling**
  - **Approximately 1.5 mg per lamp**
  - **Most released by glass retort**
- **Mercury and lead recycled into new consumer products (e.g., lamps, dental amalgam, art glass, etc.)**

Mercury Builds Up in Food Chain



NOTE: Relative concentrations are conceptual

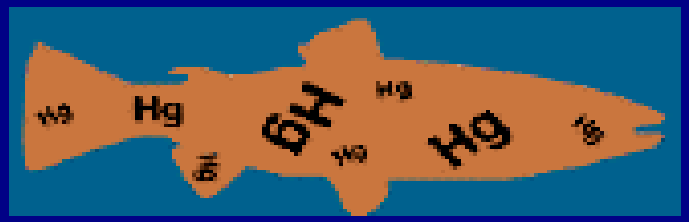
Source: NJ Mercury Task Force Report (2002), http://www.nj.gov/dep/dsr/mercury_task_force.htm

Why is Mercury a Problem?

- It accumulates in the food chain and in our bodies.
  - Like lead, it is very toxic to the brain and nervous system.
- Children exposed to mercury show behavioral and intellectual problems.

Mercury Elevated in US Fish

- 2,500+ US water bodies are under fish consumption advisories – ¾ due to mercury
- FDA warns pregnant women not to eat any swordfish, king mackerel, tile fish or shark
- Supermarkets must post warnings on certain fish under “Prop 65”.
- Environmental justice concern for subsistence fisher people



Source: US EPA, http://www.epa.gov/ost/fish/

Mercury Elevated in CA Sport Fish

- **17.8% of California's lake-acres are under fish consumption advisories due to mercury, dioxins and other toxins.**

- **Fish in San Francisco Bay have unsafe levels of mercury, PCBs, and other persistent toxic chemicals. "Adults should eat no more than two meals per month of San Francisco Bay sport fish."**

Source: Office of Environmental Health Hazard Assessment, California Fish Consumption Advisories, www.oehha.ca.gov/fish/general/99fish.html

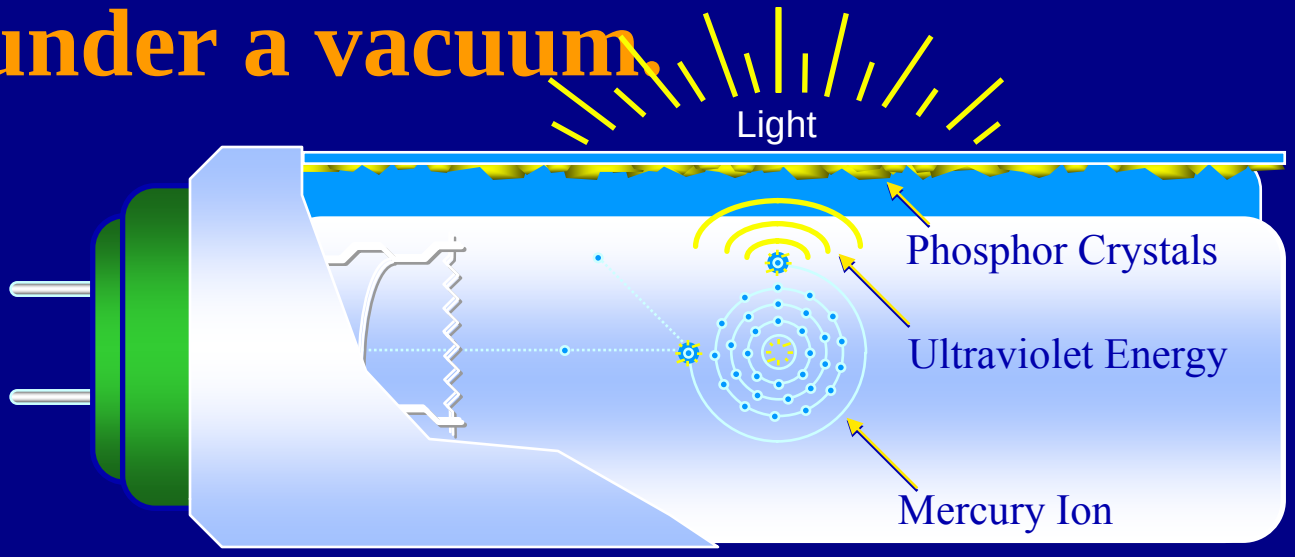
Mercury Elevated in People

One in 6 women of childbearing age (16%) in US exceeds "safe" levels for mercury.

Source: US Environmental Protection Agency, 2004

Why Fluorescent and HID Lamps Use Mercury

Mercury is added to the product to form a vapor which produces light when current is passed through it under a vacuum.



(Source: Philips Lighting Co.)

Common Types of Mercury-Added Lighting


photo credit: National Renewable Energy Laboratory

Fluorescent

- Linear tubes
- Compact fluorescent lamps
- Circular fluorescent lamps
- U-bent tubes
- Exit sign tubes
- Induction
- Cold cathode

Common Types of Mercury-Added Lighting (continued)

- **Specialty lighting equipment**
  - **UV/Disinfection lamps**
  - **Black lights**
  - **Tanning lights**
  - **Natural spectrum fluorescent**
  - **Aquarium lamps**

Common Types of Mercury-Added Lighting (continued)

- **High Intensity Discharge (HID)**
  - **High Pressure Sodium**
  - **Metal Halide**
  - **Mercury Vapor**

- **Neon Signs (up to 500 mg per 4-foot stick)**

Mercury-free Lighting Equipment

- Incandescent
- Halogen
- Low pressure sodium
- LEDs

Mercury Content by Lamp Type

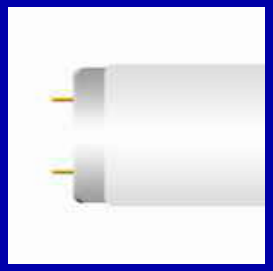
Lamp Type	Mercury content
Fluorescent	1.4 – 90 mg
Compact fluorescent	0.9 – 25 mg
High intensity discharge (HID)	0.9 mg – 1.075 grams
Specialty (e.g., neon)	0.55 mg – 5.5 grams

Source: Maine Department of Environmental Protection, *A Strategy to Reduce the Mercury Content of Products: Report to the Joint Standing Committee on Natural Resources*, January 2003, http://mainegov-images.informe.org/dep/mercury/productsweb.pdf

Mercury Content of Linear T8s Declining

Year	Mercury content of 4-Foot T8 Fluorescent Lamps (Industry Average)
1985	48.2 mg
1990	41.6 mg
1994	22.8 mg
1999	11.6 mg

Source: National Electrical Manufacturer's Association, *Fluorescent Lamps and the Environment,*
http://www.nema.org/lamprecycle/nemafluorfinal.pdf



Mercury in Fluorescent Lamps Varies

Lamp Type	Lowest	Highest
4', Linear T8, (Low-Hg)	3.5 mg	10 mg
8' Linear T8	3.5 mg	31-65 mg
4' T12, TCLP	4.4 mg	10 mg
U-bent T8	3.5 mg	31-65 mg
8' T12	6.8 mg	31-65 mg
Preheat T8 (F15T8)	1.4 mg	11-30 mg
Compact fluorescent	1.4 mg	11-30 mg

Source: EnviroSpec interviews with manufacturer representatives, 2004 and manufacturer data 2005

Lessons on Mercury Content of Lamps

- **Age matters: modern lamps = lower mercury**
  - **Avoid older "preheat" T8s and T12s**
- **Lamp life doesn't matter**
  - **It not linked to mercury content (above minimum)**
- **Shape matters: Avoid lamps with odd shapes**
  - **Circular, some U-bent**
- **Size matters: Avoid lamps with odd sizes**
  - **6", 18", 5-, 6- and 7-foot lamps**
- **Brand matters: shop around**

Mercury Content of Basic Grade 4-foot T8s

All "low-mercury" lamps not equal

Manufacturer/model	Mercury (mg)
Philips Alto	3.5 mg
Sylvania Ecologic	6 mg*
GE Ecolux	<10 mg

Source: EnviroSpec interviews with manufacturer representatives, 2004-2005

*** Sylvania's 800 series linear T8s up to 72" will have lower mercury content (3.5 mg) starting in December 2005.**

Are Some Mercury-added Lamps Non-hazardous?

- **All mercury-containing lamps must be recycled or managed as hazardous waste in California.** **(More detail on this will be presented by DTSC speaker)**
  - **Some lamps pass EPA's Toxicity Characteristic Leaching Procedure (TCLP) test, which is used to determine whether a material will leach hazardous substances if buried in a landfill.**
  - **Some lamps contain additives (e.g., Vitamin C) in end-caps to prevent mercury from leaching during test.**
  - **California does not use the TCLP test.**

"TCLP-compliant" vs. Low-mercury Lamps

- **Total mercury content = better indicator of environmental impacts**
  - **Some TCLP-compliant lamps contain less mercury than equivalent non-TCLP-compliant lamps.**
  - **BUT some contain the same amount of mercury.**

TCLP-compliant Lamps

- "TCLP-compliant" models
  - Sylvania Ecologic
  - Philips ALTO
  - GE Ecolux
  - Westinghouse Ecomax

- TCLP-compliant lamps sometimes marketed as way to reduce disposal costs
- Some manufacturers charge more for TCLP-compliant bulbs and market as "low-mercury"

Mercury in High Bay Lamps

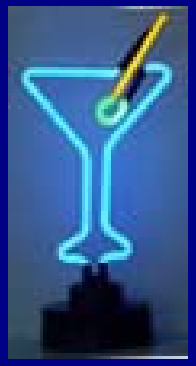
Lamp Type	Mercury Content (mg per 10,000 hours per 10,000 lumens)
250W Standard Metal Halide	35.79 – 43.18
250W Quartz PS Metal Halide	13.78 – 16.61
250W Ceramic PS Metal Halide	4.88 – 8.14
F32T8 Fluorescents (6)	3.81 – 8.71
F54 High Output T5s (4)	1.25 – 4.48
160W Induction Fluorescents (2)	1.11 – 2.49

Source: Stan Walerczyk, Lighting Wizards, June 2004

Why is Lead in Lighting Equipment?

- Lead in glass prevents shattering in lamps that reach high temperatures
- Lead solder increases operating temperature of electrical components
- Lead in PVC wire increases operating temperature

Lead in HID/Incandescent Lamps



Which types of lamps contain lead?

- **Lamps which operate at high temperatures**
  - **HIDs: High-pressure sodium, metal halide**
  - **Halogens**
  - **Neon**
- **Lamps with screw-on bases**
  - **Incandescent, halogen, HID**
- **Ballasts, fixtures, exit signs**

Lead-free Lighting Equipment

- All linear and pin-based fluorescent lamps
- Some lead-free incandescents and halogens
- Some CFLs and HIDs
  - If TCLP-compliant, must have low-mercury and be lead-free
  - New amalgam results in lower operating temperature; enables use of lead-free glass

How Do You Find Out How Much Mercury/Lead is in a Lamp?

- **You WON'T usually find it in manufacturers' catalogs or on their website, MSDSs*, the lamp or product packaging**
- **Mercury and lead content information must be gathered from manufacturers directly**

Philips Sustainability Index Calculator:
www.nam.lighting.philips.com/us/pro_lighting/sustain_calc.php?record_id=&clear_lamps=1

MSDSs stands for Material Safety Data Sheets

Require Mercury Content Disclosure

The State of New Jersey included the following language in its May 2003 lamp bid

Bidders must disclose the amount of mercury, in milligrams, for each mercury-added product bid. Space is provided on the pricing page for mercury content disclosure. Mercury-added products shall be defined as any device to which elemental mercury or mercury compounds are intentionally added.

See Notice of Award which includes mercury amounts, www.state.nj.us/treasury/purchase/noa/contracts/t0192.shtml

San Francisco Requires Mercury and Lead Disclosure

San Francisco's Precautionary Principle Policy:

The community has a right to know complete and accurate information on potential human health and environmental impacts associated with the selection of products, services…

San Francisco's contract for lamps and ballasts:

All information provided in contractor's quarterly reports, including information on the mercury and lead content of lamps supplied under this contract shall be available to the public upon request.

Specify Low-Mercury and Lead-free Lamps

- Dialog with vendors about the mercury and lead content of products you're buying
- Research drop-in replacements or new systems
- Set mercury caps and lead exclusions for models with high availability
  - Lead-free available for HPS, CFL and incandescent

Adopt European Mercury Caps

- **EU Directive, Reduction of Hazardous Substances set mercury caps in fluorescent bulbs**
  - **5 mg in compact fluorescents**
  - **5-8 mg in most T8 lamps**
  - **10 mg in most T12 and preheat lamps**
- **Some US jurisdictions are mirroring these**

For more information, see: http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_037/l_03720030213en00190023.pdf

Reduce Mercury By Using Long-Lasting Fluorescents & HIDs

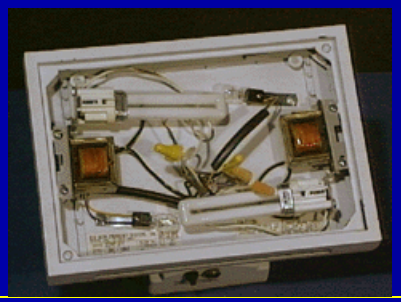
- Use long-life versions of current lamps
  - GE: F32T8/XL, T32T8/SXL
  - Philips: F32T8/PLUS
  - Sylvania: FO32/XP
- Check rated life in catalogs
  - Don't assume all long-life lamps are rated equally. Read the footnotes.
- Look for CFLs with 10K+ and HPS lamps with 40K

Reduce Mercury by De-Lamping

- Replace basic-grade T8s with premium T8s
- Significant cost savings
  - Reduced energy consumption
  - Lower maintenance and disposal costs
  - Comparable lamp costs as fewer needed
- Hi-lumen lamps do not have more mercury
- Better quality light (higher CRI)
- Consult your lighting expert or LGEP

Do Cost-effective Lighting Retrofits

- Can save money and reduce mercury
- Replace T12s with T8s (or T5s)
- Upgrade generic T8s (and ballasts) to premium lamps and extra-efficient ballasts
- Replace mercury vapor lamps with fluorescents or other more efficient technologies



Consider Changing Technologies

- Alameda County replaced 175-watt mercury vapor lamps with 42-watt CFLs
  - Less mercury in lamps
    - (~30 vs. 5 mg)
  - Shorter lamp life
    - (24,000 vs. 12,000 hours)
  - Reduced mercury from power plant emissions due to energy savings

- Replace fluorescent exit signs with LEDs

Test Innovative Low-Mercury Technologies

Try before you buy!

- Mercury-free high-pressure sodium
- LED lights
- Induction fluorescents
- Cold cathode CFLs

Reduce Mercury by Using Energy-efficient Lighting

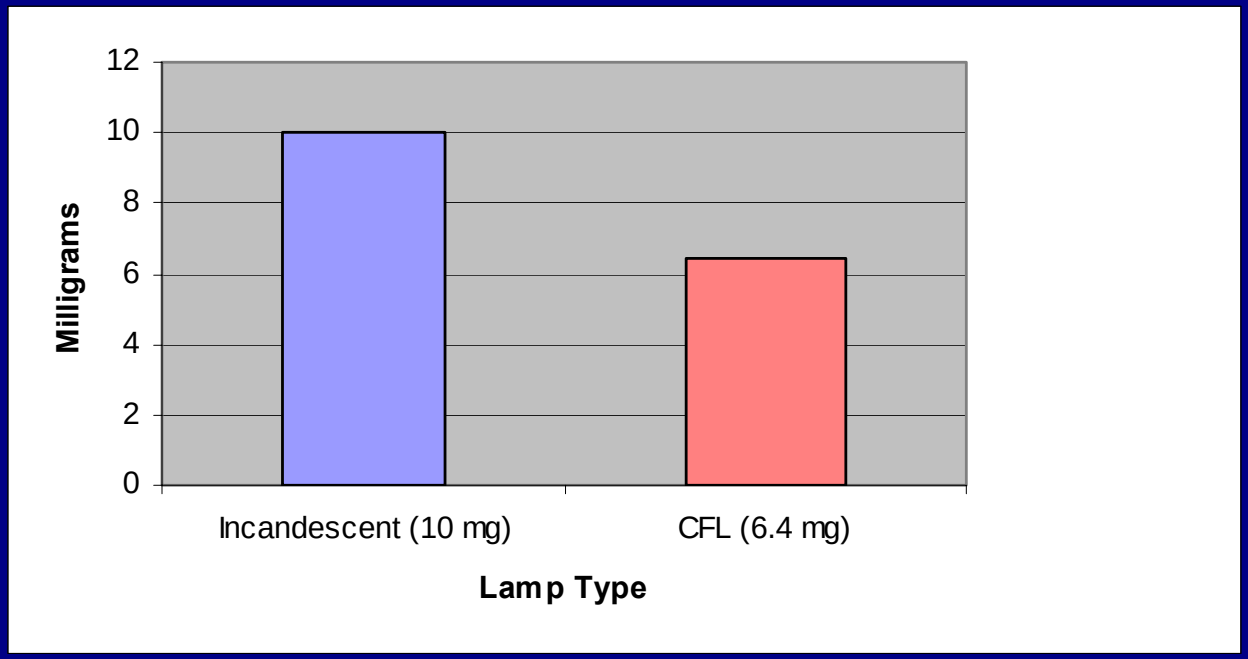
- **Compact fluorescent lamps (CFLs) use 66% less energy and last 5 to 10 times longer than standard incandescent lamps.**

  If every household in the US replaced one light bulb with an Energy Star qualified fluorescent light bulb, it would prevent enough pollution to equal removing 1 million cars from the road."

- **CFLs reduce mercury emissions at coal-fired power plants.**

See www.energystar.gov

Mercury Emissions Over 5 Years Incandescent Vs. CFL



Based on data from US Environmental Protection Agency, June 2002, www.energystar.gov/ia/products/lighting/buyers_guide/Mercury.pdf. (Data includes mercury released from coal-fired power plant and in the case of the CFL, the average mercury content of the bulb of 4 mg.)

Energy Star Compact Fluorescents

- **Hundreds of models certified**
  - **133 manufacturers worldwide including US, Canada, China, Taiwan, Hong Kong, etc.**
  - **Focus on energy efficiency, lamp life, performance**

- **Mercury, lead disclosure and restrictions needed in standard**
- **Longer lamp life minimum justified (>6,000 hours)**

LED Signal Lighting

- **Saves energy: 80-90% reduction**
  - **Incandescent bulbs use ~150 watts**
    LEDs use 25 watts or less
- **Long-lasting;5-10 times longer; lowers maintenance costs, safer**
  - **Incandescents: < l year; LEDs 5-7 years**

- **Mercury-free**

Source: "Energy-Efficient Traffic Signals," Consortium for Energy Efficiency Fact Sheet, www.cee1.org/resrc/facts/led-fx.php3.

LED Signs for Businesses

- **Reduce energy use by 90% (saving $150/year)**
- **Mercury-free**
- **Last 10+ years (100,000+ hours)**

- **No hazardous waste disposal required (although neon signs must be recycled)**

California Mercury Reduction Act of 2001

- Prevents manufacture and/or sale of mercury switches in vehicles and appliances, fever thermometers, school laboratory chemicals, batteries, and novelty items
- Does not address mercury content of lamps

USGBC LEED Standard on Mercury in Lighting

- **LEED Existing Building (EB) standard requires facilities to "maintain mercury content of all mercury-containing light bulbs below 100 picograms per lumen hour (Pg/LH), on weighted average for all mercury containing light bulbs acquired for the existing building and associated grounds."**

- **Extra credit given when average is below 80 Pg/LH**

Source: US Green Building Council, Leadership in Energy and Environmental Design, Green Building Rating System for Existing Buildings, Version 2, October 2004; https://www.usgbc.org/Docs/LEEDdocs/EB-final%20content%20version.pdf

Other State Laws on Mercury in Lamps

- **Washington State's Mercury Reduction and Education Act** directs state agencies to buy products with the least amount of mercury that meet needs.
- **Rhode Island's Mercury Reduction and Education Act:** As of January 1, 2010, mercury content of fluorescent bulbs shall not exceed 10 mg unless an exemption is granted. www.state.ri.us/dem/programs/benviron/assist/pdf/S0578Aaa.pdf
- **State of Iowa requires purchase of products with lowest amount of mercury that meet performance specifications.**

Include "Return to Vendor" Agreements

- Require vendors to take back mercury products at end-of-life
- Require certification of mercury recycling or sequestration
- Ensure companies are not "Exporting Harm"

SB 1180 (Figueroa) Mercury Lamp Recycling Act (Proposed)

This bill establishes a fluorescent lamp recycling fee paid by the manufacturer or distributor on the sale of each mercury-containing lamp in California.

The revenue generated will offset the cost of recycling and create recycling incentive payment for Universal Waste handlers.

Source: Californians Against Waste website, www.cawrecycles.org

Questions?